Generosity: A Winner's Advice

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Martin A. Nowak explores how reputation and repetition have driven the evolution of prosocial behavior in human interaction. Winning strategies are generous, hopeful and forgiving.

One day while I was still at Oxford, Bob May gave me some advice: "You never lose for being too generous". I was impressed because Bob is a winner. To him winning a game is everything. He has thought more deeply about winning and losing than anyone else I know. Strategic thinking is his basic instinct. As his wife once said, "When he plays with the dog, he plays to win." At the time, Bob was not only my advisor but also that of the British Government. A few years later he would become President of the Royal Society, Lord May of Oxford, and the recipient of many prestigious awards.

A mathematical analysis of human behaviour suggests that Bob was right. Generosity is an essential feature of winning strategies in games that explore human interactions. These strategies underpin many of the choices people make in every day life, but also shed light on how our unusually cooperative ways could have evolved.

Biologists recognize two fundamental forces of evolution: mutation and selection. I want to add a third: cooperation. The definition of cooperation is somewhat technical, but the following statement conveys the basic principle: cooperation occurs when one individual pays a cost so that another receives a benefit. Here, cost and benefit are measured in terms of reproductive success. Reproduction can be genetic or cultural, the latter involving the spread of knowledge and ideas.

Only if certain mechanisms are involved can natural selection favour individuals who reduce their own fitness to increase that of a competitor. One such mechanism is direct reciprocity. Here, my strategy depends on what you have done to me. Another is indirect reciprocity: my strategy depends on what you have done to me and on what you have done to others.

In both circumstances, mathematical analysis shows that winning strategies tend to be generous, hopeful and forgiving. Generous here means not seeking to get more than one's opponent; hopeful, means cooperating in the first move or in the absence of information; and forgiving, means attempting to reestablish cooperation after an accidental defection. These three traits are related. If I am generous, it is easier for me to forgive, and also to be hopeful and take the risk of cooperating with newcomers.

In the Wimbledon championship, you must defeat your opponent to move to the next round. But everyday life is not like a tennis tournament. Instead, most of our interactions occur in a population of players, and payoff accumulates over encounters with many different people. Because overall success is proportional to that payoff sum, the other person in any one encounter is more a partner than an opponent. If I am willing to let others have a slightly bigger share of the pie, then people will want to share pies with me. Generosity bakes successful deals.

Experiments have confirmed the success of generosity. A typical setup involves students and computer screens. The computer pairs random individuals. One person, the donor, is asked if she wishes to transfer some money to the recipient. She is informed about the recipient's decisions in previous rounds with other players. The experiment shows that people base their decision on what the recipient has done before. Generous people are more likely to receive donations.

Similar reputation-based systems operate in e-commerce. If you have a choice of buying a camera from many different websites, you might consider both the price and the seller's reputation. Consumers are willing to pay higher prices if the seller is thought to be reliable. Successful websites are those with good reputations.

So why aren't humans always 'generous, hopeful and forgiving'? Part of the explanation is that cooperation is never a stable state. Mathematical studies show that cooperation is constantly challenged by defection. In a society of defectors, where no-one helps, a cluster of cooperation can emerge, if a few people switch to tit-for-tat. If I play tit-for-tat, I do whatever you have done to me. Tit-for-tat can't persist for long, because its appetite for revenge is self-destructive. It is soon replaced by 'generous tit-for-tat'. Here I cooperate whenever you have cooperated, but sometimes I cooperate even if you have defected. I am forgiving. For a while, cooperation thrives. But in a generous tit-for-tat population, the emergence of unconditional cooperators eventually invites the invasion of defectors. This process leads to cycles of cooperation and defection, which account, in part, for the mix of cooperators and defectors that persists in human societies.

Mathematical analysis is an essential tool for understanding the fundamental aspects of human behaviour. The games described here occur in every human society. Ancestral humans spent most of their time in small groups where interactions were repeated. The same is true for most dealings in modern life, repeat encounters are always possible and reputation is typically at stake. The evolution of pro-social behaviour cannot be understood outside the framework of direct or indirect reciprocity. Indeed I believe that games of indirect reciprocity have provided the crucial selection pressures for social intelligence and human language.

In games of indirect reciprocity, social intelligence is needed to monitor and interpret the interactions of others. We follow with great interest what our fellow creatures do to us and what they do to others. When deciding how to act, we take into account — often subconsciously — the possible consequences for our own reputation. Moreover, our own observations are often not enough; we want to learn from the experiences of others. Spreading the rumours of indirect reciprocity requires language. As my colleague David Haig once remarked "for direct reciprocity you need a face, for indirect reciprocity you need a name".

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